

Section of Balneology and Climatology.

President—Dr. R. ACKERLEY.

DISCUSSION ON THE BREAKDOWNS OF MIDDLE LIFE.

Dr. J. CAMPBELL MCCLURE.

IN our mechanical age premature breakdowns will be more easily comprehended by ordinary people than formerly, when opportunities for the study of such happenings were small. Every one, for instance, knows that the breakdown of a motor-car is due to four causes: faults in construction, bad material, undue stress without sufficient rest, and mishandling of the machine.

It is the same with the human body. There are those who maintain, with some justice, that man has not yet adapted himself satisfactorily to the upright position; that even to-day the more unnatural forms of food still induce anaphylactic phenomena extremely unpleasant to the consumer; and that there are those who by their reactions take us back to a time when all ingested material was a poison which either killed or gave an immunity that afforded a new chance of advancement to the survivor. Those inherent faults in our construction are still with us after millions of years since man first appeared on the earth, and are being slowly eliminated and corrected, less by the ephemeral efforts of enthusiasts than by the slow response of tissues to changing conditions. Only in one experience in human life is this aspect important to-day, the successful resistance of our tissues to specific infections, especially in epidemic form. Our faulty construction is apparent in that our tissues, in most instances, are not naturally capable of dealing successfully with massive infections, but have to be trained before that capacity is effectively developed. This is a point that many enthusiasts ought to remember before insisting on the sun-lit, microbe-free, dietetically perfect life, in spite of which certain communities in recent times have been almost wiped out by simple epidemics such as measles.

Bad material in the construction of the human body is, perhaps, scarcely so deadly as in a machine, because in the case of living tissues, faulty material can be improved and often converted into first-grade stuff if the fault is discovered early. Even when the fault is discovered early in middle life, the faulty tissues may be so nursed as to ensure the efficient functioning of the human mechanism for the full term of a working life.

Undue stress without sufficient rest is a very fruitful source of premature breakdown. The saying that "work never kills" is simply silly. Work may and will kill if the body is not rested so as to allow sufficient time to permit elimination to get square with katabolism. True breakdowns from overwork alone are not common, but breakdowns from work in conjunction with faulty constructional material are very common, and when, by the occurrence of such a breakdown, the physician discovers the fault, the breakdown may be rightly considered later on to have been a very beneficent episode in a worker's life.

The most irritating breakdown from the physician's point of view is that which occurs in a machine made of good material, not overworked, but mishandled by a

careless, stupid, or ignorant person. Ignorance is behind many breakdowns; but when this lack of proper information is associated with reasonable intelligence, the case is never hopeless. When, however, ignorance is combined with irresponsibility, the lesson of the breakdown is forgotten too soon to be effective in the prevention of a future collapse, at least until the effects of carelessness have so damaged tissues as to make repair impossible. The later stages in such cases are extremely sad, when to physical failure is added remorse for the failure to exercise control.

Of all breakdowns the most common are those due to the failure of tissues successfully to combat a stress apart from any gross carelessness or abuse. All observers will agree that certain people are from the beginning of their life more susceptible to prevalent infections than others, more liable to fatigue, either mental, or physical, or both, who in the early years are left behind by their more powerful and active competitors. Their level of activity is low. On the other hand, it is equally apparent that in a large number of cases the hustling young man tends to slow down very noticeably in early middle-age, and may even be incapable of new impressions in the early forties. Similarly we are all familiar with the sudden death or nervous breakdown of the apparently physically robust person in early middle life. In contrast to this is the steady maintenance or even increase in capability and powers of achievement in middle life of those who had difficulty in their earlier years in keeping up to average capacity and attainment. It would appear that the slow starters, lacking something that enables many of their associates to overtake a larger amount of work than they, are saved from overstraining themselves by a knowledge of their breaking point forced on them by early and repeated experience, so that they are able to nurse carefully their faulty material to a point far beyond a large number of their more striving and robust compeers. Thus they survive middle life with less risk of serious breakdown than many apparently stronger machines. Middle age is for most of us a time of failure of power in one way or another, and when by reason of happy experiences in the past a man goes on using a forty-five to fifty year old brain and body exactly as if it were thirty or thirty-five, a time comes when a perfectly good average mechanism will break or show signs of premature wear because the period of full activity, mental, bodily and emotional, is carried beyond the normal point of safety. The limitations of tissue capacity must be realized if a full term of working life is to be expected. After complete development, the older the tissues, the less able are they to endure long strain without rest, or to recover quickly from the stress of sudden and severe emergency. They can do good work, but they require more careful handling than younger tissues.

In different groups of the middle-aged, the same strain does not hurt the same tissues. Pyorrhœa, for example, may in one group determine arthritic changes, in another fibrositis, in a third cardio-vascular degeneration, in a fourth nervous disturbances, in a fifth disorder of the digestive mechanism, either gross or functional, and so on.

It seems to me that, in middle-age, breakdowns are due to two main causes: a local vulnerability of tissues which varies in different individuals, and a general failure in the vitality of the organism as a whole. The failure of vitality lays the organism open to attack; the more local vulnerability determines the incidence of the *παληγγ*.

The normal failure of power in middle-age is, in my mind, largely due to the failure of certain endocrine secretions, notably those of the thyroid gland and the gonads. When, to this, normal failure is added the disturbance produced by the continuance into middle-age of the habits and diet of the later period of youth, which are often extraordinarily indiscreet, breakdowns more or less serious occur, affecting one or other somatic system according to the personal vulnerability of the patient.

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When to the normal endocrine failures of middle-age are added other endocrine weaknesses, many of which are congenital, the difficulties of the physician are increased, and in the present state of our knowledge it is often hard to determine without therapeutic experiment what endocrine glands need reinforcement. Such empiricism is absolutely justifiable, indeed without it progress would be impossible. If this question of endocrine faults or balance were all that was to be considered in the breakdowns of middle-age, the subject would be much simpler. There remains the question of that vulnerability of tissues which determines the incidence of the stroke that gives our picture of a disease.

The evidence before us at present does not warrant the assumption that this local weakness is necessarily due to an endocrine fault, nor does it warrant the statement that it is due to certain definite dietetic errors which, if corrected on the declaration of such weaknesses, would lead to their cure and which if corrected at an earlier date would prevent their occurrence.

I am inclined to think that, apart from endocrine errors and failures, and the bacterial toxæmia which is often the proximal cause of a breakdown, the vulnerability of various tissues is determined by biochemical faults, either of deprivation or of excess, which can be corrected by treatment on chemical lines. Such treatment must, of course, be combined with a dietary, not fixed either by general prejudice or by the ill-considered success of personal treatment, but by the careful study of the needs of each individual patient from the endocrine and biochemical point of view, due consideration being had with regard to any gross lesions which may be present. We know, for example, that all rheumatic affections are not due to the same cause, and that very similar rheumatic affections may attack people of quite different constitutions as estimated both from the endocrine and biochemical standpoint. We also know that, while a strongly alkaline water will help in one case it may be destructive in another, that one group of cases is best dealt with by sulphur water, that another does best on water containing iodine.

One thing to be remembered in the study of this question, is that the breakdowns of middle-age are due to failures of one kind or another, and it is important in all such breakdowns to see that elimination is adequate to tissue-change; to estimate the capacity of kidneys, skin and liver, and adapt the patient's life, dietetic, occupational and climatic, to suit that capacity.

Climate may play a large part in the production of breakdowns in middle-age. People who ought to live on the highlands are condemned to drag out a weary existence in Torquay; others who long for the soft climate of the west of England cannot leave Margate, Cromer or Buxton, and suffer accordingly; the effect of tropical and subtropical climates is well known, if little understood.

It is no credit to us as medical men that so many breakdowns occur in middle life. We are more occupied in attempting to "cure" a disease than in preventing it. Breakdowns of middle life due to the overstrain of a normal body are beyond the power of the physician to prevent, but those occurring without such abnormal strain are preventable in very many cases by the recognition in early life of constitutional tendencies which indicate either a biochemical or endocrine abnormality. All are not preventable, but if more attention were paid by the school doctor to the health of the slightly abnormal child or adolescent he would have fewer cases of what he recognizes as real diseases. Many breakdowns could have been prevented by a little extra care after measles or influenza occurring at school age, or by a little interest taken in a boy who felt sick or faint after exercise, but who was pronounced "all right" because no cardiac murmur or irregularity was found at the time of the medical examination. House masters are also greatly to blame who suspect that all complaints about health which are not associated with some easily detectable gross

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physical lesion, are due to the desire of the boy to shirk some disagreeable thing in the way of exercise. Perfectly healthy boys love exercise.

To take an example, it is not unusual to find a man in early middle age, the subject of pulmonary tuberculosis, giving a story of ill-health of only a few months' duration. When the history is taken, however, it becomes clear that in this man's early life there was a period during which he was just ailing, when he "outgrew his strength" or had been subject to colds in winter that "went to his chest." He survived this period without developing any typical disease, and for, say, twenty years afterwards he remained well. Then for the first time he felt ill and was recognized either as a bad bronchitic or possibly a case of pulmonary tuberculosis. Physical examination reveals the presence of creaking, coarse rhonchi, and perhaps one or more small areas, not basal, of fine crepitations, and the X-ray picture reveals the past history of the lungs, dense fibrosis and more recent cloudy shadows. The X-ray picture makes it impossible to doubt that the fibrosis is old, and a study of the X-ray picture, the physical signs and the history makes it certain that the foundation of this breakdown of middle-age was laid in early youth. Had this man's lungs and constitution been studied and treated carefully during his earlier period of ill-health, it is most likely that the later breakdown would have been prevented. The recognition in early life of a very similar constitutional fault would prevent many of those most troublesome neurasthenias and cardio-vascular disorders of middle-age, especially those associated with gastro-intestinal disturbances, due to vagus failure. Those last are very important of recognition, as they can usually be cured at almost any stage.

In opening this discussion, I have merely endeavoured to show that these breakdowns are complicated events, involving questions of general resistance and local vulnerability, biochemical and endocrine abnormalities, dietetic and climatic errors, stupidity and carelessness, both of patients and of medical men. Also that are possible of prevention more than of cure, while at the same time the conditions co-operating in their production are more often than not capable of satisfactory modification if the conditions are not allowed to drift on too long.

Dr. R. WYBAUW (Spa, Belgium).

AMONGST the troubles of middle age for which we balneologists are most generally consulted, hyperpiesia takes a very important place. The reason is that in this disease, whilst it can be treated partly at home by diet, drugs give very little help; hydropathic or balneological treatment, however, yields good results.

Our ordinary explanations of the benefit obtained by this kind of patient at our spas are too superficial. We speak of "calming the heart," and of "lowering of the blood-pressure," expressions that mean little, and even the explanations for the mechanism of high blood-pressure that we ourselves accept are certainly insufficient.

Up till now, the theory has been that the heart is the only agent in the circulation of the blood, bringing the whole of it into movement without any other assistance. The arteries have been considered as elastic tubes, nothing more, which, by keeping themselves more or less contracted, regulate the blood-flow to the irrigated organ.

If, in middle age, so many patients have an increased blood-pressure, the cause *must* be that the resistance to the outflow, on the side of the small arteries and capillaries is too strong; hyperpiesia is produced by contraction or spasm of the small arteries. In the great majority of our hyperpietic patients we find a high systolic

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pressure, but the diastolic pressure is, in a very great number of cases, normal or only slightly increased.

If we try to imitate high pressure in a system of glass tubes through which we pass a rhythmically, intermittently flowing stream of water, we notice that every increase of the resistance to the outflow causes an increase of systolic as well as of diastolic pressure. Diastolic pressure always increases at a greater rate than the systolic. If the high tension of hyperpieptic patients is caused by an increase of resistance in the small arteries, then we ought always to find the diastolic pressure distinctly raised. In practice, we usually find the contrary.

Hasebroek, of Hamburg, has written a good deal on the supposed systolic action of the arteries. His view is that, immediately after an artery has been distended by the pulse-wave there is an active reflex contraction of the arterial wall pressing on the blood. All the various parts of the arteries are subsequently excited, all contract one after the other, and this causes something like a peristaltic compression running along the arteries of the whole body, immediately following the pulse-wave.

The question was investigated by several German, Swiss and Czecho-Slovakian physiologists, and they obtained mostly negative results. It seems probable that the active movements of the arterial wall are very difficult to detect, because they appear so shortly after the greatest distension of the artery, so that it is quite impossible to differentiate them; also, these movements are so weak in normal arteries that no method can detect them directly.

Several writers showed that when artificial circulation is established through an organ, the quantity of fluid passing through is larger when the flow of the stream is rhythmic than when it is continuous. In their experiments the rhythmic stream exercised a mean pressure equal to the pressure of the constant stream. The accurate experiments of Fleisch showed that this result is due only to the elasticity of the blood-vessels. No active collaboration of the arterial wall was required to explain the fact. We performed fresh experiments on the leg of a dog, on fresh kidneys, on human placental arteries, on the carotid arteries of sheep, and we found that when the stream was rhythmic these organs yielded a greater outflow than under a constant stream, even when the mean pressure was decidedly lower than the pressure of the constant stream. In that case, mere elasticity could not be regarded as the cause of the phenomenon, and we accepted the result as being due to an active response to pressure by the arterial wall. It is remarkable to see how a placental artery can increase the volume of a blood-stream when it is rhythmic. This artery is the one of which the muscular coat is the strongest of all.

We also made direct experiments on arteries, on the aorta of dogs and on carotid arteries of sheep shortly after death; the arteries were submitted to the action of a rhythmic stream, and put in a kind of plethysmograph communicating with a Marey's recording cylinder. The movements of the artery when opened by the systolic wave, then kept open by the systolic pressure in our tubes, and during the collapse when the stream was cut off, were inscribed on the cylinder. When we first examine what happens if, instead of an artery, we insert a very elastic rubber tube into our plethysmograph, we see that, when the pulse wave reaches the tube, it opens suddenly; this strong positive wave is followed by a short negative wave, due to a short elastic reaction of the wall. Then the tube keeps open as long as the high pressure lasts. When we put in the aorta instead of our rubber tube, we obtain an identical curve. If there is an active systolic reaction, this must occur together with the small negative wave. In order to ascertain whether this was really the case, we added adrenalin to our fluid (Locke's oxygenated and warmed solution). After a short time the negative wave became stronger and stronger, and a very marked active

reaction of the arterial wall was noticed. On the other hand, when we replaced adrenalin by a weak solution of morphine, the negative wave quite disappeared: this drug had stopped any active reaction in the arterial wall. In carotid arteries the reaction to adrenalin was not so positive, but the details of our tracings, which were taken at a very low pressure of the irrigating fluid, indicated a strongly developed response of the arterial wall to the pulse wave.

After having shown that high blood-pressure is not to be explained by spasm of the arteries, Hasebroek connected a water reservoir with a system of glass tubes and rubber tubes, and applied an apparatus resembling a cuff to a part of his rubber tube, somewhat similar to those cuffs we use in measuring blood-pressure but filled with water. He constructed his apparatus in such a way that, immediately after the rhythmic pulse began, a compression was made on the rubber tube. This was comparable to the effect of a contraction of the arterial wall directly following the onset of the pulse wave. He was able in this way, and in this way only, to increase the systolic blood-pressure, without changing the diastolic pressure; by regulating the external compression he succeeded in regulating the high systolic pressure at will.

Let us now consider the state of our patients. It seems probable that hyperpietic patients have an arterial wall that responds too strongly to the excitation caused by the sudden shock of the pulse wave. There are reasons for supposing that their arteries indeed are too sensitive to any kind of excitation. It is known that in normal men or in normal animals the blood-pressure is the same in the arms as in the legs, but in many there is a tendency to a slightly higher pressure in the legs. In hyperpietic patients the difference is very frequently a great one; there is some relative hypertension in the legs.

The experiments made by Pezzi, Fulchiero and Lusiada, have shown that, when the blood-pressure is taken first at the forearm, and then another cuff is applied to the arm, a pressure just a little higher than the diastolic pressure is indicated, while the blood-pressure in the forearm increases. We have verified this and find it to be rare in normal persons; but it is the rule in hyperpietic patients. The cause of the phenomenon is that when compressed by a pressure just a little above diastolic pressure, the artery collapses during diastole: immediately afterwards it is violently distended by the pulse; and this violent shock seems to be an excitant to the reaction of the wall, but more so in hyperpietic people than in normal, because their arteries react too strongly.

We may therefore consider hyperpiesia as a state in which the local (probably nervous) reactions of the arterial wall are too strong, because there is some hyperæsthesia of its nerves.

There may be another cause of increased response of the artery, not arising from hyperæsthesia of the nerves. This may occur when the shock of the pulse wave is too strong,—in aortic incompetence, for example. There we generally find the blood-pressure in the legs much increased compared with the pressure in the brachial artery, a fact which was pointed out by Hill and Flack years ago, and which is very difficult to understand if the action of the arteries is similar to that of india-rubber tubes.

Danze, Brody and Miles last year (*Proceedings of the Society of Experimental Biology and Medicine*, 1926, vol. xxiii, p. 454) published a paper on pressor substances found in the blood of hyperpietic subjects. Do these substances act by themselves, or do they activate some internal secretions, like surrenal secretions, which cause hypertension? After the experiments we have carried out, we think the unknown pressor substance does not itself act directly on the arterial wall, but causes hyperæsthesia of the arterial nervous mechanism.

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What have these facts to do with our special balneological work? The connexion is indicated as follows:—

Our treatment has twofold effects. Hyperpietic (and often gouty) patients are poisoned by bad hygienic conditions and too rich food. At home, dietetic treatment may reduce their blood-pressure to a certain extent, but the only way further to reduce blood-pressure is by balneological treatment. Drugs are of but little use except in the treatment of some complications.

Balneological treatment is effective in such cases, first, because it acts on the metabolism, especially upon the metabolism of nitrogen; and secondly, because it has a calming effect on the nervous system, and soothes the irritability of blood-vessels. We see the difference between systolic and diastolic pressures diminishing after a fortnight, and after a month's treatment we generally obtain a lasting result.

Our idea (purely hypothetical) is that the reflexes in the artery are under control of the same nervous influences as the heart. Several experiments which we have made seem not only to indicate that the arterial wall is able to contract or to dilate,—as has always been accepted, but also that the immediate reflexes we have mentioned depend on exciting and moderating nervous influences. Nerves somewhat resembling the accelerans and vagus nerves appear to have their endings in the arterial muscles. And why not? Is not the heart a part of a differentiated blood-vessel, and do we not know of a vertebrate, the amphioxus, which lives without a heart, and upon whose blood-vessels alone devolves the control of the whole of the circulation of the blood? Our patients with heart trouble seem to be strengthened because the treatments act on the tonus of their vagus nerve; perhaps the same occurs in the blood-vessels of hyperpietic patients.

In any case, we see that the treatment of such patients has a more complicated effect than we hitherto supposed. The balneological "cures" act on the nervous system, on the heart and its nerves, on the vessels and their nerves, perhaps on internal secretion, certainly on metabolism. That is the reason why we cannot ascertain the result obtained when the patient is leaving the spa, and why so often the complete effect of a treatment does not appear for some weeks afterwards.

Dr. R. FORTESCUE FOX.

IN an address delivered before the Hunterian Society¹ in 1922, the breakdowns of middle life were described primarily as a disturbance of all the great systemic functions, in varying degrees, which might subside, or lead on to anatomical changes in particular tissues or organs.

The analysis of many cases, at present unpublished, appears to confirm this hypothesis. If it proves correct it must modify the current views upon the ætiology and treatment of many disorders and so-called organic diseases in middle life.

The functions, in one or more of which the first signs of disorder are manifest, are naturally in order as follows: Mental, nervous, circulatory (cardio-vascular), metabolic (including endocrine function, digestion and assimilation), the eliminatory functions, and lastly, the functions of the locomotive organs (muscles and joints). The dependence of all these activities one upon another is obvious. If, for example, a disorder arises in elimination or assimilation, toxic matter or malnutrition may supervene in the whole body. Similarly, an endocrine disturbance speedily causes mental, nervous, circulatory, and digestive disorders. The same effect of disturbance of one function upon all the others is seen in most mental disorders. In fact, so

¹ *Lancet*, 1923, (i), 55.

closely are the great organic systems related that it seems impossible in many cases to decide in which of them some obvious disturbance has originated. In the common cardio-vascular diseases of middle life, especially those accompanied by hypertension and hyperpiesia, the circulatory disturbance is generally a secondary effect. Similarly, it is questionable how far the nervous centres are responsible for the great majority of nervous disorders. It is in the nature of these centres that their normal or abnormal activity should be evoked by external causes; that is to say in the afferent nerves or in the blood-stream.

According to this view the breakdowns of middle life should be regarded as general and not local diseases, and as probably connected with changes in the fluids of the body. The disturbance can be detected over a wide field, and even when one function or organ seems to be the chief sufferer, there may be others quite as much affected, and which may even be primarily at fault. An anatomical-pathological diagnosis describes rather the results of disease, and may overlook these underlying widespread disturbances.

To what causal factors may these widespread disorders of health in middle life be ascribed? Their incidence is heavy in the decade 45 to 55. This is generally recognized to be a period of physical involution and adjustment both in men and women. It is also the period of maximum strain, both physical and mental. Like the phases of adolescence and senility, the middle epoch of life has its own peculiar liabilities in normal health, and it is not unreasonable to believe that it influences any processes of disease which may take place while it lasts. Happily, it also gives them a transitory character. After the causal factors, epoch and strain, come injurious habits: unsuitable food, stimulants and narcotics, accumulation of waste, want of exercise and oxidation, often occurring together. Another serious factor cannot be overlooked—accidental invasion of micro-organisms, which become pathogenic on this well prepared field of lost immunities to disease.

In the address already mentioned, certain common types of illness in middle life are described and illustrated, in which the predominant symptoms are respectively mental, cardio-vascular, thyroid, arthritic, etc. Family histories often show similar forms of illness recurring in successive generations. This is especially true of the illnesses of middle life and perhaps of the adolescent and the senile periods also. For example, arterial disease with cerebral hæmorrhage at 50 or 60 years of age (death at the same age being not uncommon), mental breakdowns at the climacteric period, the less acute forms of arthritis and many forms of chronic rheumatism, are met with in certain families much more frequently than in others.

From such observations as these it may be legitimately deduced that family tendency is a chief factor in determining the localization of disease in middle life. A general disturbance of the equilibrium of health, with disorders of many functions due to epoch, strain, injurious habits and micro-organisms, leads on naturally to more serious and permanent disorders and tissue change in the most susceptible parts. For this reason the investigation of family history in middle life has much more than academic interest. It is essential that it should be undertaken in order to comprehend the morbid liabilities of this period, and above all to provide an effectual preventive treatment. It is, of course, a truism that in all the illnesses of middle life that can be characterized as "breakdowns," an escape, at least temporary, must be made from the conditions in which the illness originated. Change of habits, regulated rest and exercise and holidays, fasting, elimination of alcohol, saline and Turkish baths, are everyday prescriptions, sufficient for all the less serious cases of middle-age disturbance, mental and physical. But there is a very large and perhaps increasing number of cases in which these simple remedies are insufficient. In spite of the best treatment

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at home, the patients often go from bad to worse and the general disturbance settles down into localized disease. Sleep or mental equilibrium fails, or the pulse remains too frequent; arterial hypertension, wasting or obesity are not checked; the skin, kidneys or bowels remain still inactive, or pains and swellings in and about the joints do not disappear. Careful rectification of possible sources of infection still leave these persons very far from well, with marked general disturbance of health and increasing signs of local disease.

From this class of case the health resorts draw large numbers of their more serious visitors. At many health resorts the tonic or sedative climate is itself a remedy of no slight importance, especially when combined with regulation of diet, rest and exercise in the open air. This is much, but the spas offer more—internal treatment by a variety of waters and also different forms of external treatment. Both at climatic stations and at spas, special sanatoria for more serious cases are, or might be, founded. A whole armoury of physical remedies applied under the most favourable conditions is therefore available in these health centres. Does it not follow that upon the practitioners at the spa, climatic station and sanatorium must devolve the care of this important class of case. Above all, the scientific hydrologist has the means at his command, not only of arousing dormant nervous reactions, but also of allaying excessive nervous or cardio-vascular excitation; of correcting defective elimination whether by bowel, kidneys or skin; of increasing oxidation and metabolism; of modifying chronic inflammatory processes and of dispersing morbid exudations and deposits.

The adjustment of these remedies of the spa and health resort to the diseases of middle life is a very fine art. If the spa practitioner could study the circulatory and nervous reactions evoked by baths,—the external treatment of sensitive subjects, treatments could sometimes be modified from day to day with much advantage. Many patients require the most sedative applications that can be devised, others need a daily increasing stimulus. Like strychnine, bromides and arsenic, baths and waters are edged tools, and their selection and dosage must be guided in every case by the reactions observed. This is more especially true with the varied and intricate disturbances of health occurring in middle life.

Dr. W. J. TYSON (Folkestone).

The breakdowns of middle life depend largely on the bringing up of the child. Provided that the child is well cared for as regards environment—feeding and clothing, and that this treatment is carried out up to adolescence, there will be few breakdowns in middle life; if when this time has arrived common-sense rules relating to feeding, exercise, moderate work, etc. are observed—old age can be reached and enjoyed. It is impossible in a few remarks to mention, far less describe, all the details of these rules, but these need not be many nor need they be complicated.

Dr. H. A. ELLIS.

How one approaches middle life is largely a constitutional question. It depends to a great extent on whether during earlier years we have (a) been normal individuals, whether (b) we have had a difficulty of assimilation and have therefore been subject to metabolic deficiency, or whether (c) we have already shown a tendency to deficient elimination. Taking these as the three types of constitution one can definitely say that those who early display difficulties in elimination are subject to premature

age, are liable to cardio-renal disorders in early middle life and that they have an unhealthy future in front of them.

It must be remembered that life is an acid phenomenon in an alkaline or neutral medium, and that age has a tendency to increase that acidity at the expense of the environmental alkalinity. So we have these three types of constitution and these types definitely control middle-age conditions and the ailments of the individuals approaching that period. These three types may be called (1) the acid or assimilation error type, (2) the normal or balanced type, and (3) the elimination error type. The urinary excretions of these three types are totally different and capable of accurate recognition when their elimination and acidity are considered. Acid is eliminated in the urine in two ways, (*a*) as free acid and (*b*) as salts, when the acid is combined with ammonia.

Now the ratio of these two to each other differentiates the constitution in its acid relations, and that differentiation will reveal the acid characteristics likely to occur in middle life. In the ordinary healthy individual the proportion of ammonia to free acid is in the neighbourhood of 2 to 1, or the average ratio. Those, however, who encounter metabolic strain and elimination difficulties will have a reducing ratio till they arrive at the 1 to 1 ratio. This is the acid type, with elimination difficulties, that forms such a large proportion of those who consult us for disabilities in middle life. These patients essentially tend to become cardio-renal cases with a rising blood-pressure and an increased differential pulse due to the need of getting rid of their accumulated waste acid, and their diminished capacity for its elimination. It must be understood that acid is the main controller of the kidney function, so a deficient capacity for acid elimination on the part of the kidney is the chief reason for the onset of cardio-renal deteriorations and disturbances. The acids formed by vital processes must be eliminated or their accumulation will cause degenerative disturbances on an accelerating plane. The question is, how these disturbances can early be recognized and obviated. There are three ways by which waste accumulation can early be recognized: (1) By observing the *rise of blood-pressure and increase of differential pulse-pressure*. This indicates the deterioration of the renal *elimination function*. This deterioration necessitates an extra pressure in order to facilitate the filtration of the excessive waste products. (2) By *investigation of night micturition*. The most important consideration for middle age is, do the patients have to pass water at night, and if so, how often? That also usually co-ordinates with kidney deterioration. A man is not really as old as his arteries, but as old as his kidney capacity, which controls the deterioration of the arterial walls. (3) *By urinary analysis*, the earliest and best way. For this two samples are necessary, the one passed on waking after a night's sleep, secreted under the metabolic conditions of rest, equable temperature, and absence of food and drink. This may be called the standard or rest urine. The second specimen is the next one passed, that is the first one secreted after waking in the morning and passed, say, after breakfast. In normal individuals, if sleep has been sufficient and the kidneys are unimpaired, all the accumulation of free acid has been excreted during the night. Then this second urine will have little or no acid in it. In the average normal individual its specific gravity will drop about 10 degrees lower. The

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reaction will be probably alkaline. This second urine may be called the tide urine. It shows to what extent elimination is complete in an acid-accumulating case. With a deteriorating kidney the tide differences will be much smaller or will have disappeared altogether. So the two specimens, instead of being separated by a specific gravity of 10 degrees, will be approximately equal. The acid also will not be reduced; the tide urine will approximate to the rest urine, showing that accumulation is occurring and the night elimination has not been sufficient to get rid of the waste. The blood-pressure and night micturition will further confirm this. As the case retrogrades the night specific gravity tends to become lower and the tide to become higher until the difference between them entirely disappears.

If, on the other hand, the case belongs to the assimilation error group these disadvantages cannot occur, as, where there is not sufficient assimilation, there cannot be difficulties of elimination.

These facts show the way to treatment in acid cases, which will naturally consist in controlling waste formation, more than in aiding accumulation, if the age clock is to be definitely and satisfactorily put back. Increasing elimination is only a palliative treatment, very efficient and satisfactory if the deterioration has not gone too far; this is duly apparent from the improvement achieved in the various watering places where the physicians have studied the elimination side of the problem to its scientific limit, and where the results are practically excellent. But if the condition is not to recur the waste production must be controlled either by diminishing intake or diminishing work, and this can only be satisfactorily accomplished by studying the urinary results to see how far the state of the tide urine can be improved by diminishing the amount of acidity which is found in it; it will then co-ordinate with a diminished blood-pressure and longer periods of undisturbed sleep.

In the other group of cases, that is, those in which there are assimilation errors in youth and in which there is an ammonia ratio of 3 to 1 in relation to the free acid, the patients grow old quite differently. Should they deteriorate in middle age, their error will be found to be one of the endocrine balance, this being naturally deficient. These patients have a low blood-pressure, a differential pulse-pressure below 44, and they do not pass water during the night. They also have a good tide. In other words they have no acid accumulation, but their endocrines tend to fail; hence their fatigue and other disabilities.

A few words on endocrine failure may be interesting. Endocrines do not fail all equally, nor altogether, so it is of great importance to find out the one that deteriorates first, for if it can be replaced by a suitable dose the endocrine balance can be re-established and all will be well.

One word of warning: endocrines are usually not needed in the acid constitution with elimination errors, as, naturally, if elimination is already deficient no further accentuation of this condition is advisable or beneficial. Indeed, if the patient's health does improve temporarily, that may lead to a still more serious breakdown.

In this connexion, recently, in a case in which ill-health followed the administration of small doses of parathyroid I found that the cause of the ill-health was an acidosis thereby produced, and the pH fell very nearly to 7.2, there being also a considerable deficiency of the bicarbonate reserve. This was remedied by giving 10 gr. of sodium bicarbonate

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whenever a dose of thyroid was administered, as the thyroid deficiency still existed, and the condition of deterioration was successfully remedied by giving the sodium bicarbonate as well.

These observations I hope will render possible a discussion as to how far middle-age deterioration is, as the opener pointed out, a constitutional biochemical and endocrine question.

NORMAL CASE.					
		Rest			Tide
Titrateable acidity	...	26	...	...	4
NH ₃ , combined acid	...	48	...	...	25
NORMAL ACID CASE.					
Titrateable acidity	...	38	...	...	8
NH ₃ , combined acid	...	48	...	...	12
ACID CASE.					
Titrateable acidity	...	45	...	...	31
NH ₃ , combined acid	...	54	...	...	43
NORMAL ALKALINE CASE.					
Titrateable acidity	...	12	...	...	6
NH ₃ , combined acid	...	27	...	...	20

Dr. MOUGEOT (Royat).

I will briefly discuss the question of high blood-pressure on balneological treatment. Dr. Wybauw has shown the part played by increased reflex contractility of the arteries of muscular types. I think the cause of that resides in increased tonicity of the sympathetic system. This system has a large domain under control, many parts of which contribute to the production of hyperpiesis, increasing the activity of the heart muscle, and also the tonicity in the arterioles and the capillaries.

Krogh has shown that capillary tonus is regulated by the pituitary secretion and the sympathetic nerves. I think that both carbonic-acid baths and also radio-active hyperthermal baths reduce the high blood-pressure, by their soothing effect on the sympathetic system; and that amongst the different kinds of effervescent baths the most efficient are the naturally thermal waters with a weak amount of CO₂ and radio-active properties.

Dr. WM. P. KENNEDY (Bath)

said he thought that monotony in dietary, even when controlled in quantity, deserved a place in the consideration of the influences affecting the breakdowns of middle life. It was not so important as the subject of over-feeding, but it was an aspect of the question one could not afford to neglect.

Mr. H. L. ATTWATER.

Speaking as a surgeon I would say that the urinary passages show a remarkable power of resisting organisms; this is demonstrated by the frequent presence of bacteria in the bladder, which are derived either from the urethra below or from the

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kidneys above, and which do not cause any disease or disability. Further, if there is an infection, following upon some primary source of irritation, such as a vesical stone, this will most frequently disappear rapidly when the source of irritation is removed.

In middle age, however, when there is a general slackness of the abdominal and lumbar muscles, which is due to a fatty infiltration and a loss of tone, the urinary passages are subjected to less vigorous disturbance from without; the patient's condition becomes more sluggish, and there is a much greater tendency to stagnation and to a less rapid clearance of the urine from the channels. This favours stasis; infections become much more common and lead to one of the forms of breakdown in middle life. Spa treatment in such cases is very valuable. The imbibition of large quantities of diuretic waters, such as those of Contrexéville or Vichy, causes the urine to pass more quickly along the canals and will tend both to prevent and to check the onset of sepsis.

With regard to the remarks of Dr. Ellis, with whom I have been associated during the last two years, whilst he sees a majority of nephritic cases which belong to the "acid" group, the cases which I see of infections of the urinary passages belong to the "alkaline" group. "Acid" cases are exceptional.

Dr. PAUL FERREYROLLES (La Bourboule).

There is something more in the mineral spas than régime, rest, exercise and fresh air, to enable patients to fight against the miseries of middle age; there is the mineral water itself.

As Dr. McClure has rightly remarked, the clogging of the human machine is perhaps the result of our own misdeeds, but also of our previous illnesses, which have left our organism filled with toxins. It is well to increase their elimination, and to diminish their absorption, but it is best to complete their destruction. I have had the opportunity, on a previous occasion, of telling you something about the anti-anaphylactic power of some mineral waters.

Certain of them act not only on the organism but also on the toxin itself. This has been recently proved by the eminent physiologist, Professor Billard, who has shown that the waters of Mont Dore and of La Bourboule destroy the toxic power of spartein; that the toxic action of phallin of certain fungi is destroyed by the Source des Chanteurs at Mont Dore; that adder venom is destroyed by the water of Châtel-Guyon; the diphtheria toxin by that of Saint-Nectaire, and the poison of tetanus by the water of La Bourboule, and in a lesser degree by that of Royat.

You all know the extraordinary influence on the phenomena of life played by certain ions in infinitesimal doses. This has been shown by Raulin in the use of silver and zinc salts, by Bertrand working with manganese, and by Bertrand and Machebœuf employing nickel and cobalt.

Realize that you can find more than sixty (component) minerals in Vichy water; that if the intoxication of middle age is complex the mineral waters also are

complex, and that you can find in them, and in them alone, the ions or groups of ions, able to neutralize these toxins. It is to the effect of these ions that we attribute the results of spa treatment. I earnestly recommend you to study the experiments of Professor Billard and to repeat his experiments with your own waters. You will then be armed against the polite scepticism of some general practitioners and patients and be enabled to say why you believe in the efficacy of mineral waters.